A sole for shoes including transpiration side valves formed by moulding

The present invention relates to a sole for shoe including a plurality of valves distributed along its outer sides that allow the shoe to transpirate and to keep its impermeable property unchanged.

It is known that the basic problem of shoes provided with sole of plastic material consists in that the sole of the foot is not able to perspire in a suitable way.

To overcome such problem a number of solution have been proposed to improve the foot aeration and to allow the interior of the shoe to communicate with the outside.

Italian Patent No. 1,296,111 in the name of the same Applicant discloses a sole for shoe having a plurality of check valves in the thickness of the sole for discharging the inner air which are made of membranes of elastic material in which microholes are formed. The membranes have a concavity directed to the sole of the foot under which a room or a pre-chamber is formed communicating at the lower side with the outside of the sole.

During walking, when the pressure in the outer pre-chamber exceeds the inner pressure of the membrane, the holes in the concave membranes are closed, thus making the shoe impermeable.

Such a solution offering, however, the maximum

reliability, has only one limit: it cannot be used in many cases where the design of the tread of the shoe sole cannot be modified because it is conditioned by the function performed. Reference should be made for instance to the shoe soles for trekking and climbing boots that have treads provided with prominent raised patterns indispensable for the shoe to grip the soil upon walking. It should also be mentioned the case in which metallic or plastic means are secured to the shoe sole or heel to provide anti-slipping or anti-ice functions with respect to the road, as taught for example by Patent IT 1,229,575.

There is also the need to find alternative solutions not involving the tread of the sole.

Patent GB 2 290 016 discloses an aerated sole which is fully made of elastic material and has at the upper side a plurality of protrusions provided with through holes which communicate at the lower side with a plurality of horizontal channels extending within the sole and reaching side openings. However, such solution allows on one side foul air to flow out of the interior of the shoe to the outside, thus ensuring the aeration without passing through the sole of the shoe, on the other side disregards at all the problem of the impermeability of the shoe which is at least compromised as there is no means that prevents liquids from entering the sole.

Such a trouble does not exist in a commercially available sole which is provided with inner channels conveying air to an output side opening which is

closed by a plastic valve that prevents liquid from entering. Such plastic valve is anchored to the side of the sole in a step after its moulding, which involves an additional cost which is added to the inherent cost of the valve and makes such a solution uneconomic. Further, the overall dimension of this valve is such that only one valve can be used only at the plantar area with the result that its effectiveness in exchanging foul air inside the shoes is compromised.

The present invention seeks to overcome all of the problems and the limits described above by providing a sole with air discharging valves of elastic material which are disposed at the sides along the periphery of the sole and can be easily made in only one step upon moulding the sole.

This has been accomplished according to a first embodiment by providing a sole with a peripheral channel conveying air moved during walking to one or more valves embodied in the side of the sole from a plurality of aeration chambers, consisting of protrusions, dome-shaped chambers or igloos which are hollow and opened at the upper side towards an inner perforated transpiration sole of the shoe. Advantageously, such valves consist merely of a membrane or diaphragm provided with microholes and having a convexity to the outside and closing a channel passing through the side of the sole. Advantageously, such valves can be made in one piece

and in one moulding step together with the sole, the membrane being perforated mechanically in a later step.

In a second embodiment the protrusions or igloos are replaced by a sole of elastic material with the same thickness and a low specific gravity, on which the inner perforated transpiration sole of the shoe can rest, provided that the peripheral channel and the valves still remain. With regard to this, it should be appreciated that air is expelled during walking even if the aeration chambers are not present as a temperature above that of the foot of the walker is reached inside the shoe so that the sweat produced by the sudoriparous glands of the foot sole in the presence of enzymatic or bacterial flora helps a fermentation which produces an inner pressure inside the shoe which is higher than the outside pressure, thus causing air to escape through the side valves.

A better understanding of the invention will follow from the following description with reference to the accompanying drawings that show only by way of a not limiting example a preferred embodiment thereof.

In the drawings:

Figure 1 shows a perspective view of a shoe with a sole provided with side discharging valves according to the present invention during walking;

Figure 2 is an elevation side view of the outside of a

sole of Figure 1;

Figure 3 is a view of the same sole of Figure 2 with a length of the sole broken away;

Figure 4 is a longitudinal section of the sole;

Figure 5 is a partially sectioned top plan view of the sole of the preceding Figures showing the shape of the valves inside the side of the sole;

Figure 6 is a cross section of the preceding sole along the plane VI-VI of Figure 5;

Figure 7 is a cross sectioned portion of a variation of the sole of Figure 6 where it is shown that an inner sole of the shoe which is perforated and able to perspire lies on a plurality of protrusions;

Figure 8 shows a top plan view of another variation of a partially sectioned sole with a different shape of the igloos;

Figure 9 is a cross section of the sole of Figure 8;

Figure 10 shows a sports shoe in which the sole consists of a rubber tread to which the side valves open and above which a polyurethane member is placed;

Figures 11a-11d show plan views of a set of shapes of

shoe soles with different designs of the protrusions or igloos;

Figure 12 shows a variation of the invention in which the plurality of protrusions are replaced by a layer of light material;

Figure 13 is a longitudinal section of a variation of the sole of Figure 12.

With reference to the Figures, in a first embodiment the sole designated by 1 and fully made of elastic material provides:

- a generally vertical side 10 which extends in height from the foot bearing ground and to which the upper of the shoe is partially secured;
- a plurality of dome-shaped chambers, igloos, protrusions or the like 15, on which the foot rests with the interposition of a perforated transpiration sole 16. Each chamber or igloo is provided at the upper side with a through hole 14 connecting the interior 19 thereof to the outside and allows air in the shoe to be expelled whenever the igloos are pressed during walking;
- a small channel 21 which follows the periphery of the area containing the igloos and conveys the air from the igloos during walking;
- a plurality of check valves embodied in the sole, each of them consisting of a thin membrane 2 which is provided with a microhole 2a and closes a conduit 4

passing through the side of the sole and connecting the interior of the shoe to the outside through a side opening 3.

Such a solution allows a quite impermeable sole provided with side transpiration valves to be provided easily and economically in only one processing step by resorting to common devices which are known to those skilled in the art of moulding (such as moulds with opposing pins to provide through conduits and membranes 2), thus strongly reducing the cost.

In the embodiment shown in Figure 5 the valves are six, four of which near the tip and two at the heel. As can be seen from the cross section of Fig. 6 at the middle of the sole, small channel 21 and vertical side 10 define a level surface which is used to secure the upper.

Fig. 7 shows a cross section of a portion of another sole where the valves are right opposing on both sides. The same Figure also shows by way of example the securing of the upper to the shoe, designated by 20, in part to the vertical side and in part to area 17.

All of these cases refer to soles of elastic material, particularly rubber, made in only one moulding step. The sole described, however, has also the advantage of being made of two materials with different densities, for example rubber and polyurethane, as shown in Figs. 8 and 9. In this case, apart from the fact that the protrusions or igloos 15 have a generally elliptical shape with a wide upper opening 14, the side 10 is

made of polyurethane, and tread 18, protrusions 15 and side valves are made of rubber by moulding. This is accomplished by the insertion of the tread and its components after moulding into the lower plane of a mould before the polyurethane which is a material with a lower specific gravity is injected. In order to prevent the polyurethane from entering the small channel 21 and the area of the protrusions 15, a vertical small wall 23 following the small channel 21 is provided integral with the tread 18 and having a height equal to the protrusions 15.

It is evident that a sole of such type is much lighter than the sole of rubber which is made in only one moulding step. This feature has become most important upon coming of sports articles such as tennis, chopping, running, trekking, etc. where the soles have high thickness as well as large volumes. Fig. 10 shows by way of example a shoe of this type where the thickness of the sole does not lay heavy on the weight of the shoe as only the tread 18 is of rubber while the layers 25 are of polyurethane.

In order to provide a much lighter sole, as its thickness cannot be reduced by aesthetic reasons, especially in soles for the winter collection, or to provide a sole with a thin thickness, especially in soles for the summer collection, the aeration chambers which are formed by protrusions or igloos 15 can be avoided and replaced by a layer 27 of plastic material which is elastic and much lighter than rubber, as can be seen in Fig. 12. In case such material is not

transpirating, the layer can be provided with a plurality of channels or grooves 28 to ensure a correct air circulation. As already mentioned, the lack of igloos does not impair the function of the side valves to expel the air flowing inside the shoe and conveyed from the small channel 21 through the perforated transpiration sole 16, as the pressure of the air inside the shoe is still greater than the outside pressure because of fermentation processes.

In conclusion, the aerated sole according to the invention resorting to valves located sidewise and made by moulding has a number of advantages:

- as the plane area of the sole has no valve, the tread of both summer and winter soles can have any design;
- the side valves allows the air to flow from the interior of the shoe to the outside even at the heel and also without aeration chambers;
- the side valves do not interfere with the designs of the treads that can also be very prominent and deeply carved;
- the plane area of the sole without valves can be provided with anti-slipping means according to the current technology.